

What is claimed is:

Sub A > 1. A method for manufacturing and analyzing a semiconductor die, the method comprising:
2 forming a plurality of heating elements in the die;
3 while operating the die, selectively controlling the heating elements and therein
4 causing at least one of the heating elements to heat at least one adjacent portion of the
5 die; and
6 analyzing the die via the operation.
7

1 2. The method of claim 1, wherein operating the die includes running a test pattern
2 on a portion of the die suspected to cause a failure.

1 3. The method of claim 1, wherein operating the die includes electrically coupling
2 the die to a signal generator adapted to supply test signals to the die.

1 4. The method of claim 1, further including detecting that the die is
2 malfunctioning.

1 5. The method of claim 4, further comprising:
2 identifying the portion of the die being heated at the time that a malfunction is
3 detected; and
4 correlating the portion of the die being heated to a critical timing path.

1 6. The method of claim 5, further comprising probing circuitry in the critical
2 timing path and determining therefrom the nature of a defect.

1 7. The method of claim 1, wherein the die includes at least one of: a flip-chip
2 bonded die and a wire-bonded die.

1 8. The method of claim 1, further comprising selectively controlling the heating
2 elements and therein causing at least one of the heating elements to draw power in a
3 manner that slows the operation of circuitry in at least one adjacent portion of the die.

1 9. The method of claim 1, further comprising electrically coupling the die to a
2 package, wherein selectively controlling the heating elements includes applying an
3 electrical signal to the heating elements via the electrical coupling to the package.

1 10. The method of claim 1, wherein selectively controlling the heating elements
2 includes causing a portion of the die to heat to a selected temperature.

1 11. The method of claim 1, wherein selectively controlling the heating elements
2 includes heating a plurality of the heating elements in a selected sequence.

1 12. The method of claim 1, wherein selectively controlling the heating elements
2 includes causing at least two of the heating elements to generate heat, and wherein the
3 at least two of the heating elements are located sufficiently distant from each other so

4 that heat from one of the elements does not interfere with heat from another one of the
5 elements in causing the die to heat.

1 13. The method of claim 1, wherein selectively controlling the heating elements
2 includes causing the at least one heating element to generate pulses of heat.

1 14. The method of claim 1, wherein selectively controlling the heating elements
2 comprises:

3 grouping the heating elements into selected groups, each group having two or
4 more heating elements;

5 causing the selected groups to heat in a sequence;

6 detecting a response from the die that indicates that the die is operating
7 defectively; and

8 in response to detecting the defective operation, identifying the selected group
9 being caused to heat when the response is detected; and

10 selectively operating individual heating elements of the selected group.

1 15. The method of claim 1, wherein selectively controlling the heating elements
2 comprises:

3 detecting a temperature characteristic related to the heated portion of the die;
4 and

5 in response to the detected temperature characteristic, controlling the heating via
6 a feedback loop.

1 16. The method of claim 15, further comprising forming a temperature sensor in the
2 die, wherein detecting a temperature characteristic includes detecting the temperature of
3 a portion of the die using the temperature sensor.

22
1 17. The method of claim 16, wherein forming a plurality of heating elements
2 includes forming a transistor having a gate, and wherein forming the temperature sensor
3 includes electrically coupling the temperature sensor to provide feedback to bias the
4 gate, and therein regulate the current through the transistor and control the heat
5 generated.

1 18. The method of claim 1, wherein selectively controlling the heating elements
2 comprises:

3 electrically coupling the heating elements to a heat controller; and
4 supplying a signal from the controller to the heating elements and thereby
5 controlling the heating elements.

1 19. The method of claim 1, further comprising forming a control register in the die,
2 wherein selectively controlling the heating elements includes using the control register.

1 20. The method of claim 19, wherein selectively controlling the heating elements
2 includes providing a serial signal to the control register and using decoding and lookup

3 blocks at the control register to interpret the signal and activate one or more heating
4 elements based on the interpreted signal.

1 21. The method of claim 1, wherein forming a plurality of heating elements in the
2 die includes forming a grid of heating elements.

1 22. A system for analyzing a semiconductor die having a plurality of heating
2 elements formed therein, the system comprising:

- 3 control means for selectively causing at least one of the heating elements to
- 4 generate heat and to heat a portion of the die therefrom;
- 5 operating means for operating the die; and
- 6 detection means for detecting a response from the die.

1 23. A system for analyzing a semiconductor die having a plurality of heating
2 elements formed therein, the system comprising:
3 a controller adapted to selectively cause at least one of the heating elements to
4 heat at least one adjacent portion of the die;
5 a testing device adapted to operate the die; and
6 a detector adapted to detect a response from the die.

1 24. The system of claim 23, wherein the testing device and the controller are
2 included in a single testing arrangement.

1 25. The system of claim 23, wherein each heating element includes at least one of:
2 resistive metal, a transistor, a diode, doped metal and a polysilicon trace.

1 26. The system of claim 23, wherein the die further comprises a temperature sensor
2 formed therein and adapted to provide temperature feedback, and wherein the controller
3 is further communicatively coupled to receive the temperature feedback and to control
4 the heating in response thereto.

1 27. The system of claim 23, further comprising a stage to hold the die and
2 electrically couple the die to the testing device.

1 28. The system of claim 23, further comprising a computer communicatively
2 coupled to the tester and adapted to control the tester.

1 29. The system of claim 28, wherein the computer is further communicatively
2 coupled to the controller and adapted to direct the controller's operation.

1 30. The system of claim 23, wherein the detector and the testing device are included
2 in a single arrangement.

1 31. The system of claim 30, further comprising a computer communicatively
2 coupled to the controller, the testing device, and the detector, and wherein the computer

AMDA.478PA (TT4019)
June 2, 2000

- 3 is adapted to control the analysis of the die and to provide response results from
- 4 analysis for review by a user.

2000 RELEASE UNDER E.O. 14176